

# Future Telecoms Infrastructure Review: Call for Evidence

## Contribution from Cisco

Cisco is the world-leading IT company and has been driving technological advances in networks since 1984. We work with a range of telecoms service providers right around the world to help them deliver for their customers. We are delighted to contribute to the UK Government's call for evidence on future telecoms infrastructure and would be very happy to elaborate on any of the points raised below.

### 1. What is the existing UK telecoms market structure and policy framework able to deliver?

- **When will it deliver, and how certain can we be that it will fulfil the Government's ambitions for full fibre networks and 5G deployment?**
- **What will this mean for roll-out of these technologies and for competitive models in different geographic locations?**

The UK has a strong and globally respected regulator in Ofcom and regulatory system for telecoms. It has delivered a stable, predictable environment that has encouraged investment and has been aware of the need to understand the dynamic technology, consumer and market environment. In this context, the UK regulatory framework and broadband policy has served its purpose well, with 91% of UK premises being able to receive superfast (30Mbps download speed) broadband.

However, new technologies, changing network use and unlocking the potential for digitisation to be a driver for innovation and economic growth makes it imperative for the UK to keep under consideration how the framework for encouraging investment in telecoms and broadband can be globally-leading and provide the UK with the right digital infrastructure.

When it comes to the availability of full-fibre and high-speed mobile networks, the UK seems to be lagging when compared to other major countries. According to Ofcom's [Connected Nations 2017](#) report, only 3% of UK residential premises have access to 'full-fibre' services (albeit from a very low base, that that number is starting to rise) and the National Infrastructure Commission's [Connected Future](#) study, the UK ranks 54<sup>th</sup> globally in terms of 4G coverage.

Internet traffic in the UK continues to grow and with digitisation a much more heterogeneous mix of services and applications will be requiring ubiquitous, high-quality, scalable and extensible networks. Looking at Cisco's [Visual Networking Index](#), an annual forecast of internet traffic around the world, UK IP traffic is expected to grow from 4 exabytes (4 billion gigabytes) per month to over 10 exabytes per month by 2021, a compound annual growth rate (CAGR) of 22%.

The VNI shows that internet video will be a major driver of this increase – rising from just over 2 exabytes per

month in 2016 to 6.5 exabytes per month in 2021. Along with increased video viewing, the UK will see more marked peaks in internet traffic associated with people's viewing habits – by 2021, busy hour internet traffic will have grown 4.5x whilst average internet traffic will grow 2.9x from 2016 levels.

Numbers of devices connected to the internet in the UK are also expected to see a rapid rise over this period. In 2016 there were 371 million devices connected to the internet – in 2021, this will rise to 629 million. This equates to a rise of 9.5 connected devices per household in 2016 to 16 devices per household in 2021. This increase in the number of connected devices will have critical implications for the kind of networks we need for the future. M2M devices will account for half of all connected devices in 2019 and while only representing 3% of traffic, a significant proportion of M2M and IoT applications will have important quality of services requirements.

Further, the much more diverse mix of devices delivering a wide range of services and applications will often be running simultaneously, sharing the same Internet connection. While this adds up to increasing requirements on network capabilities, it is about much more than just adding bandwidth (though that will certainly be needed too). It also makes requirements of traffic much more heterogeneous, necessitating intelligent networks that can cater to these different needs. Some services will require both bandwidth and be latency-sensitive, e.g. HD or UHD video.

Other services may have low bandwidth requirements while being very latency-sensitive, e.g. self-driving cars and similar real-time controlled applications. Other applications will have low bandwidth requirements and also not be latency-sensitive, e.g. a sensor in a field measuring soil quality. In the same manner, symmetric speeds will overall become more important. Even though in terms of volumes traffic will remain somewhat asymmetric, with consumer video consumption continuing to outpace consumer-generated content, the increased uptake of cloud services and cloud-based services will require more symmetric speeds. Symmetry will in particular also be crucial for many business and advanced services, e.g. HD or UHD business video conferencing or telemedicine for the healthcare sector. We therefore need extensible and scalable networks that can support gigabit speeds and quality of service parameters as relevant per service and application.

A further opportunity for the UK is digitisation of existing physical infrastructure. As pointed out by the [National Infrastructure Commission](#) there are major opportunities for the UK to upgrade road, rail and urban environments through digital infrastructure. Effective and speedy deployment of digital connectivity in these environments could lead to advantages for the UK in developing and deployment new technologies around smart cities, autonomous vehicles and new services for rail passengers across the country.

We therefore welcome this call for evidence as an opportunity for the UK to reinvigorate its drive towards encouraging investment in the right digital infrastructure to allow the UK to become a global digital leader.

The UK needs to see a step change in the levels of network investment over the coming 5-10 years and telecoms infrastructure policy therefore needs to strengthen incentives for all operators to invest. This does not as such require a fundamental rewrite of the existing regulatory framework or abandoning competition as a core tenet of telecoms regulation. The principles behind the current framework remain sound but some of the tools need readjusting to find a more appropriate balance between maintaining competition and creating stronger incentives for investment whereby the UK can move towards more infrastructure-based competition. Where the market does deliver healthy levels of investments, such investments should be incentivised and trigger more flexible treatment. This will require a different approach to market definitions and analysis, with clearer signals embedded in it, and a greater focus on prospects for competition. This approach should be

supplemented with additional measures, including public funding, for challenge areas where competitive build out is less likely to happen.

**2. What barriers exist to long term investment in the UK telecoms market (beyond work underway by the Local Full Fibre Networks programme to stimulate demand, and by the Barrier Busting Taskforce to reduce build costs)?**

- **What effect do existing revenue streams have on investment plans?**
- **What effect do visibility and predictability of returns have on investment plans?**
- **What is the effect of current infrastructure deployment models?**
- **What impact do current infrastructure sharing arrangements have on investment?**
- **What is the impact of the existing relationship between wholesale and retail markets?**
- **What changes to spectrum licensing and sharing could foster greater innovation and investment in 5G?**

First and foremost, the UK requires the right certainty for investors. As the UK comes through the Brexit process, investors in the telecoms sector (as well for consumers and other sectors of the economy that drive investment in telecoms) need a long-term view of telecoms regulation and incentives to invest. Continued, proportionate alignment of regulatory approaches will be useful to helping encourage cross-border investment. Investors in telecoms will look for the right levels of certainty from any regulatory environment that the investments they are making will lead to returns over a specific period of time. This is also relevant when considering investments in urban connectivity solutions for the deployment of smart city solutions and where major commercial investments are needed to digitally upgrade existing physical infrastructure such as providing digital connectivity on rail and road networks.

A second potential barrier to long-term investment in markets such as the UK that needs to be avoided is looking too narrowly at competition when considering what regulatory approaches are needed. The UK should adopt an approach that takes a broad understanding of competition when considering whether regulatory remedies are required. When competition is assessed too narrowly, the risk is that new networks become regulated when rolled out by the SMP operator. The primary purpose of regulating networks is to ensure competitive outcomes and choice for end-users. Therefore, in a converging digital world all competitive pressures should be taken into account even if there are not part of the defined wholesale market. Cable, mobile and other forms of connectivity and retail services should be increasingly brought into play when considering whether competition issues exist in a particular market.

Thirdly, taking a wider view of the market also implies an increased use of geographic segmentation in the regulatory approaches in the UK. Often markets are defined on a national basis (as retail prices apply nationally) whereas the reality or prospect for competition varies greatly within that national market. This is especially apparent in the UK. Even though geographic segmentation is also, in theory, possible within the existing EU regulatory framework the UK operates under, it has been little applied (not just in the UK but in most EU countries).

Where there is a real opportunity for consumers to switch among competing infrastructures, mandatory access obligations on NGA networks may not be necessary to protect competition and may have the unintended consequence to unduly discourage broadband investment. Ex-ante regulation will likely continue to be needed in rural and other white areas where a sparse population or other factors make it unlikely that a competition will arise organically in the foreseeable future.

Whilst not limited to, co-investment and infrastructure sharing should be encouraged as sharing the risk could

enable investments to take place in otherwise underserved areas. Where this would lead to better digital infrastructure for the UK and better outcomes for consumers and businesses co-investments and the like should be free to develop and operate on commercial terms, with an ex post enforcement should competition concerns arise. A further interesting development to watch will be whether new players, for example from the current OTT ecosystem, will look to deploy fixed and mobile infrastructure and look to directly compete against existing players.

Fourthly, this kind of flexibility should be complemented with measures that help lower the cost of deployment, as promoted in the broadband cost reduction directive. Civil engineering works and digging is estimated to represent around 80% of cost. Sharing access to expensive, passive infrastructure through access to ducts, conduits and in-building wiring can help to significantly reduce the overall cost of network investments. This incentivises and enables all parties to invest.

Finally, spectrum availability is critical for 5G and in particular alignment with spectrum bands that will be utilized in Europe. A publicly available plan for the release of spectrum, pursuant to existing UK government practice in this area, provides needed certainty for investment. However, there are several aspects of 5G spectrum that are often overlooked. One is that 5G networks will have significantly increased capability to integrate with different radio systems at the edge. The most important of these from a consumer perspective is Wi-Fi. Therefore, regulators need to pay attention not just to licensed spectrum that operators might use, but also whether sufficient license-exempt spectrum will be available to support the next generation of Wi-Fi that is being designed to meet the demands of 5G-level use cases. Second, the flexibility of 5G from a technology and use case standpoint will be unprecedented, and it is likely that enterprises will want to operate private versions of 5G networks on their premises, indoors and out as part of their own IT operations. There is little opportunity today for enterprises to utilize very small geographic networks at low cost. To fully take advantage of all that 5G can achieve, some consideration should be given to “private LTE”. Sharing approaches and/or lightly-licensed approaches should be considered.

### **3. What can the UK learn from the widespread deployment of fibre networks in other countries?**

- **What factors have led to higher full fibre investment in other countries and how applicable are these to the UK?**
- **What have been the impacts of fibre roll-out models in other countries on competition dynamics, consumer bills, and risk allocation?**
- **To what extent can the fibre that has been rolled out internationally be used for mobile backhaul, and what lessons can the UK learn?**

When compared to EU countries, the UK performs comparatively well when looking at superfast broadband connectivity, ranking 8th with 92% coverage. However, when looking at full fibre connections, the UK struggles when compared to EU countries – the UK comes third from bottom with just 3% of premises having access to full fibre services. And when looking at 4G coverage, the NIC highlighted that the UK ranked 53<sup>rd</sup> globally in 2016.

Within the EU, a first group of countries that present interesting case studies are the Baltic States. The three Baltic States refrained from introducing strict cost-oriented fibre access obligations and all three countries rank above EU average ultra-fast NGA coverage. Hungary, Poland and Slovakia on the other hand introduced stricter fibre-access regulations and these countries all rank below the EU average with in particular Poland and Hungary lagging behind.

Another group of countries that have achieved significant progress in the rollout of NGA networks are Spain, Portugal and France. These three countries pursued a similar approach to incentivise new investments in NGA networks (in these cases FTTH networks) by imposing access to physical (passive) infrastructure in order to facilitate competitive build-out and at the same time through removing active layer access remedies in urban areas for the new FTTH networks. While all three countries had different starting positions, they all took actions to address weaknesses in the regulatory regime in order to give effect to their policy designs. For instance, Spain traditionally had a relatively weak access regime in place to give alternative operators control of LLU lines and had an, at- best, ‘nascent’ passive access regime. In 2008 Spain dropped LLU prices by more than 20%, which led to a significant increase in full LLU take-up by alternative operators moving from a base of approximately 700,000 lines in mid-2008 to 1.5 million in mid-2009 and 2 million lines by early 2010. This created a strong competitive base on which to build and ensure an anchor product whereby the active layer remedies on any new FTTH buildout could be relaxed, capping access products at 30Mbps. This ensured retail-level competition for end-user choice and at the same time created strong incentives for alternative operators to invest to be able to differentiate themselves and compete with high-quality, high-speed offers.

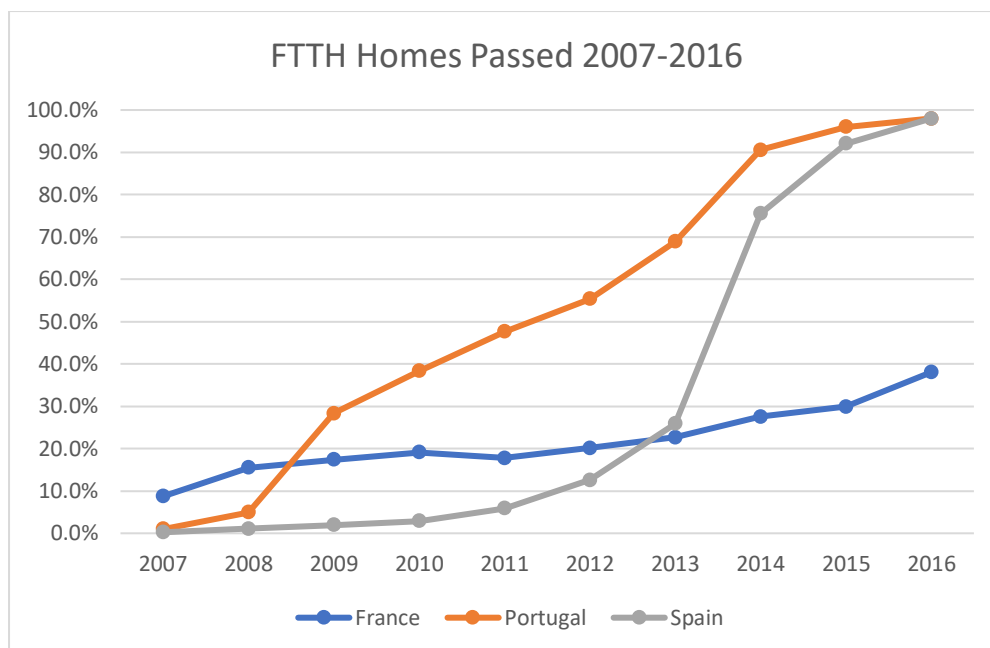
In Portugal, the NRA geographically segmented the market into urban and rural areas and removed any virtual access remedies in the urban areas and instead shifted emphasis to enable infrastructure builds. LLU on copper also continued in the urban areas. To enable infrastructure builds, legislation provides for all existing ducts suitable for the provision of electronic communications network to be made available to operators. This duct sharing had been mandated in national law as early as 2002 and the common ownership of the telecom and cable operators at that time led to extensive duct access and sharing between the two infrastructure providers. Since 2009, the NRA decided to implement a Centralised Information System, a central infrastructure atlas aimed at reducing the cost of deploying new electronic communications equipment. Providing and regularly updating information is mandatory for all organisations that own or operate infrastructure suitable for accommodating electronic communication infrastructure (including roads, railways, water and gas infrastructure). This requirement applies to local authorities, state-owned companies, utility companies, electronic communications companies, and any other bodies that may own relevant infrastructure. It extends further to the incumbent, Portugal Telecom, which must provide information on available space within its ducts. While different authorities (NRA, local authorities, ministry) can be involved in infrastructure mapping and at different levels (central/local), most of the activity is in the hands of national authorities. Like Spain, all new builds and major renovations must install fibre in the building.

Similarly, in France, national legislation dating from 2008 and 2009 has not provided for virtual access over FTTH networks in dense building areas. Instead, regulatory measures have concentrated solely on lowering deployment costs through the sharing of infrastructure. Under the law of August 2008 any operator has an obligation to give geographical data on its network to local authorities on their demand, free of charge. Access to infrastructure, overseen by the French electronic communications and postal regulatory authority (ARCEP), is to be provided on a non-discriminatory basis by Orange, which must grant reasonable requests for access, make capacity available where constraints exist (“desaturation”); and provide planning information.

ARCEP has implemented three main measures since 2009. The first two relate to the shared point at which the MDU is connected to the operators’ fibre networks (the shared connection point), and applies to all MDUs in densely populated areas. The third measure concerns the installation of in-building wiring in all new buildings which like Spain and Portugal imposes obligations on building owners of new buildings and for renovations to install fibre in the building.

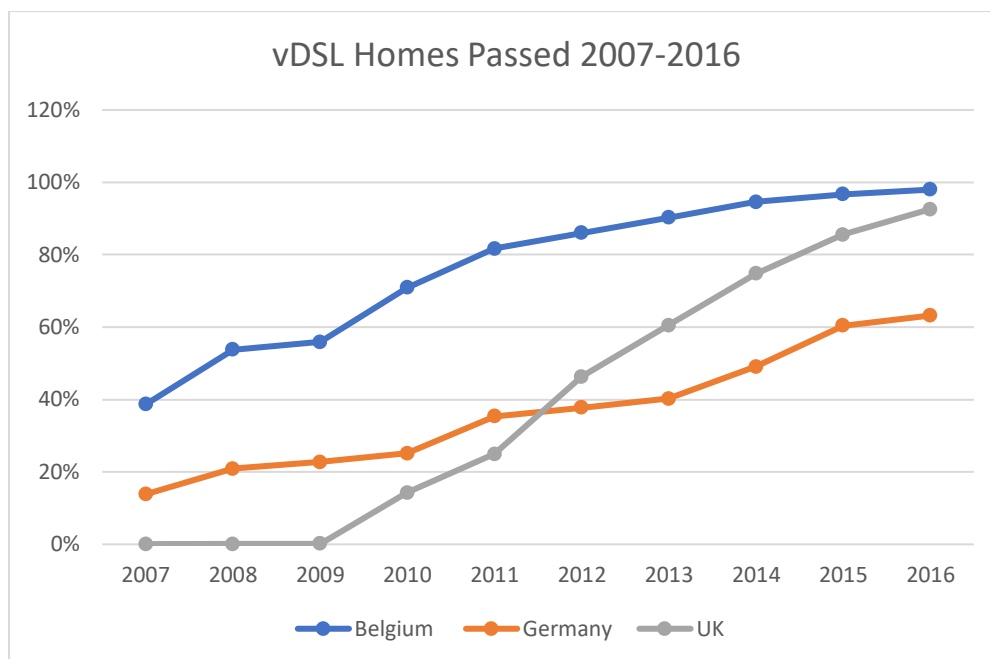
Figure 1 below shows the progress Spain, Portugal and France have made on fibre roll outs.

Figure 1: FTTH Homes Passed in France, Portugal and Spain, 2007-16



In terms of which other EU countries the UK most closely resembles on regulatory approaches, the UK sits best alongside Germany and Belgium. These three countries sought to reward NGA investment, in these cases focusing on VDSL investments, is worth noting for comparison purposes. In all three countries, VDSL investments have been supplemented with higher rewards: in the case of the UK, BT was awarded very significant public money to extend the VDSL network by the BDUK fund; in Germany, access conditions were not overly onerous; while Belgium went so far as to withdraw the sub loop unbundling (SLU) obligation on the incumbent Proximus in order to facilitate vectoring (a further technology increment on VDSL) effectively ruling out any form of access other than virtual remedies. Figure 2 below shows the expansion of VDSL in Belgium, Germany and the UK in recent years.

Figure 2: VDSL Homes Passed in Belgium, Germany and UK 2007-16



The different regulatory choices in the group of Spain, Portugal and France and Belgium, Germany and the UK have in one way achieved the same objective: NGA coverage. However, one striking difference is the outcome in terms of market structures. The approach pursued in Spain, France and Portugal incentivised all market players to invest and ensured that investment was made possible by lowering costs through the passive layer access regime. The result of these interactions is that a very large number of access paths have been created, owned by different, independent operators. This enables commercial or not conventionally regulated access deals between network owners and a forward-looking view sees these markets relying on competition between copper, cable and more than one FTTH network. This is important if what we want to achieve is the kind of self-sustaining infrastructure-based competition that will enable us to rely on market pressures for continuous network investments.

Mobile backhaul in the 5G era will be subject to somewhat different market dynamics than in the past. At the edge of a 5G network, there will be more demand for fibre servicing transmitters that will be more intensively deployed than the 4G base stations of today. While some of that edge backhaul capacity might be addressed through wireless solutions, there will need to be significant additional fibre at the edge. More generally, as traffic continues to build on 5G networks, there will also be a need to add capacity to existing mobile backhaul arrangements. While there is little doubt that mobile operators will be able to take advantage of existing fibre networks to meet growing backhaul needs, new investment decisions (e.g., whether to build, buy or lease) will be highly operator-specific based on their unique 5G deployments and services.

4. **The Government wants to consider all market models that will facilitate the next generation of technologies.**
  - a. **What different market models\* might work in the UK in the longer term, and what risks and opportunities do they present?**
    - **What consequences could different market structures, including ones which support longer pay-back periods, have on the investment environment, competition and outcomes for consumers?**
    - **How might these vary in different geographic areas of the UK, including urban and rural areas?**

- **Over what timescale could market models be changed, and what policy conditions would be necessary to enable this?**
  - **Are the current arrangements for BT legal separation working effectively?**
- b. What should Government consider when assessing the potential for migration from copper to full fibre networks?**
- **Over what time period could migration occur?**
  - **What phases might migration be required to go through?**
  - **What would be the pros and cons for markets and competition?**
  - **What would the implications be for different groups of consumers?**

Going forward, market analysis in relation to telecoms regulation should focus more on prospective competition and cumulative market pressures. This also implies an increased use of geographic segmentation as the scope for potential investment and network competition is largely driven by density (cost per access line) and access to ducts and in-building wiring.

In those areas where there is a real opportunity for users to switch between competing infrastructures, mandatory access obligations on NGA networks may not be necessary to protect competition and may have the unintended consequence to unduly discourage broadband investment. This kind of regulatory approach should be combined with cost reduction measures where obligations to share access to ducts, conduits and in-building wiring help significantly reduce the barrier to invest.

Ex-ante regulation will likely continue to be needed in rural and other white areas where a sparse population or other factors make it unlikely that a competition will arise organically in the foreseeable future. Various regulatory incentives could be explored, including co-investment. It should however also be recognised that full coverage of high-speed, high-capacity and reliable networks will not be achieved without some level of public funding. The promotion of public-private partnerships of open access network models should also be explored.

It is unlikely that there will be a strong case for private investment in more than one network outside of high-density areas. Precisely because it is less likely there will be a genuine market to deploy competing networks in rural or other white space areas, some form of access obligations will likely be needed to ensure at least some retail-level competition (though that could be a co-invested/shared infrastructure in which case there would nonetheless be competition on the retail level). At the same time, the UK should assess different possible available regulatory tools to incentivise investment as much as possible in sparsely populated and rural areas.

We support the assessing of various regulatory models and incentives and how potential models of co- or joint investment models might be facilitated. Today this seems to be a little used model partly out of uncertainty that NRAs will then determine joint-dominance triggering access remedies for further third parties. Beyond ensuring regulation does not inadvertently discourage co-investment models, as per the joint dominance example, regulation should not mandate co-investment. The experience to date suggests that co-investment models work best when done in a commercial rather than regulated setting.

In addition to regulatory incentives, it should be recognised that the UK will not achieve full coverage of high-speed, high-capacity and reliable networks without some level of public funding. A key element of public funding should be better use of existing funds for these purposes, notably structural funds. It should also be further explored how state aid can be better employed, amongst other through public-private partnerships.



**5. The Government wants to achieve its digital infrastructure goals at the least additional cost. How should new digital infrastructure be paid for?**

- **Are consumers (residential and business) willing and able to pay for new digital infrastructure, given its expected benefits?**
- **What could incentivise investors and shareholders to make long-term investment decisions in telecoms infrastructure?**
- **What is the potential role of government in stimulating demand or otherwise de-risking new infrastructure investment?**

New digital infrastructure should primarily be paid for through the private sector, incentivised by the right regulatory framework. Greater use of geographical segmentation should be used to ensure regulatory approaches are tailored to different areas to maximise the amount of commercial investment. In genuinely challenging areas, the UK may need to consider some public funding as it has done in the past with BDUK along with sensibly designed Universal Service Obligations that minimise any potential market distortions.

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